

## APPENDIX J

## ROAD MOVEMENT PLANNING

Units that move convoys on MSRs, ASRs, or other controlled routes must understand how these routes are controlled and how to use them. Convoy operations require two types of control--area and organizational. This appendix focuses on area control. Both organizational and area control are discussed in detail in Chapter 5 of this manual.

**J-1. AREA CONTROL.** The commander who controls the area/terrain through which convoys move exercises area control. This type of control is normally exercised through movement control channels and is known as highway regulation.

a. **Highway Regulation.** Highway regulation involves planning, routing, scheduling, and deconflicting the use of routes to facilitate movement control. It seeks to provide order, prevent congestion, and enforce movement priorities. The goal of highway regulation is to sustain movements according to the commander's priorities and make the most effective and efficient use of road networks.

Responsibility for highway regulation rests with commanders having area jurisdiction. The highway regulation mission is performed by--

- The TMCA and transportation battalions (MC) in the COMMZ.
- The transportation battalion (MC) in the corps rear area.
- The DTO in the division rear area.
- The brigade S4 in the brigade rear area.

MC detachments may perform highway regulation when assigned a geographical area of responsibility within the COMMZ or corps rear area. The TMCA, movement control battalions, and DTO monitor highway regulation in subordinate command areas. Based upon the tactical situation, they may also regulate some of these routes.

b. **Clearance Requests.** A request to move on a controlled route is known as a movement bid. A movement bid is a form or message that details the itinerary of the move, the number and types of vehicles, and movement planning information. The authority to move is passed to the moving unit as a movement credit. A movement credit is an alphanumeric identifier.

Units needing to move on controlled routes that require a movement credit must request and receive clearance before beginning movement. Units use the traffic circulation plan and the highway regulation plan to obtain information on the road networks and determine if a movement bid is required. The request is submitted through logistics channels to the DTO or corps/EAC MC detachment within whose area the movement originates. Based on procedures established in SOPs, the request may be transmitted in hard copy, electronically, or verbally. Figure J-1, page J-2, shows a sample movement bid.

TO: 502 MCC		THRU: 51st Trans Bn		FROM: 151st Trans Co		DATE: 15 Feb XX EXT # 46061	
SECTION I. MOVEMENT DATA							
MOVING UNIT 150th Trans Co	CONVOY CDR CPT Nedry	START POINT GRID: ND610397		RELEASE PT GRID: NE010900		TYPE OF MOVEMENT  Unit Move	
		LOC: Smith		LOC: Dover			
MOVEMENT DATE: 1 Mar XX			SP TIME: 0800		MOVEMENT CREDIT # 3		
CONVOY ORGANIZATION	# SERIALS 3	SERIAL GAP 10 Min	#MU 3	MU GAP 5 Min	VEH GAP 100m	RATE OF MARCH 50	
CHECK POINTS	DISTANCE (KM) BETWEEN PTS	ARRIVE CLEAR		ROUTE DESCRIPTION		CRITICAL PTS/ HALTS	
CP4 (SP)		0800	0833	MSR Dart			
CP8	10	0812	0845	MSR Dart			
CP5	15	0830	0903	MSR Dart			
CP1	10	0842	0915	MSR Dart			
CP13 (RP)	5	0848	0920	MSR Dart			
SECTION II. VEHICLE/LOAD DATA							
CONVOY COMPOSITION, OVERSIZE/OVERWEIGHT VEHICLES							
# OF TRACKS	# OF WHEELS 87	HEAVIEST VEH/WT/MLC M915/M872 Tractor Trailer, 53,401, 45MLC					
QTY	MODEL	DESCRIPTION	LOAD INFO	L	W	H	WT
95	M915/M872	TRACTOR/TRAILER		668	96	115	53,401
5	M1009	CUCV		192	95	75	6,720
2	M936A2	WRECKER		362	97	118	36,010
OTHER/HAZ MAT							
REQUESTER'S NAME, TITLE, PHONE: 1LT Christy, Pltn Ldr, 868-6315							
SIGNATURE:							
SECTION III. AUTHENTICATION							
MOVEMENT CLEARED BY: _____							
AT DTG: _____							
CLEARANCE PASSED TO: _____							
AT DTG: _____							

Figure J-1. Sample movement bid

The DTO, MC detachment, or transportation battalion (MC) reviews and considers movement bids based on command priorities for the type of movement and the unit requiring movement. They either schedule the movement as requested or, if a credit cannot be granted, notify the unit and schedule the move at a different time or on a different route. Movement credits are returned to the requesting unit through the same channels used for the request.

**J-2. PLANNING FACTORS.** Planning factors are basic to the process of planning and organizing convoys. This section provides the formulas and information necessary to plan highway movements and develop movement tables.

a. **Movement Measurement.** Movements are measured by calculating how long it takes to move a convoy over a route. These calculations involve time and distance factors.

Movement planners should use rate of march in performing movement calculations. The rate of march is the average number of kilometers expected to be traveled in any specific time period. Because the rate of march is an average, it compensates for short periodic halts and short delays caused by congestion. It does not include long halts, such as those for consuming meals or for overnight stops. March rate is expressed in kilometers or miles in the hour.

b. **Time-Distance Factors.** Time and distance factors are used to perform a wide range of calculations for planning highway movements and to develop movement bids or movement tables.

(1) **Distance factors.** Distance factors are expressed in kilometers or meters. The terms used to describe distance factors are as follows:

- *Road distance*--the distance from point to point on a route, normally expressed in kilometers.
- *Gap*--the space between vehicles, march units, serials, and columns. It is measured from the trail vehicle of one element to the lead vehicle of the following element. The gap between vehicles is normally expressed in meters. The gap between march elements is normally expressed in kilometers.
- *Road space*--the length of roadway that a convoy occupies. It is measured from the front bumper of the lead vehicle to the rear bumper of the trail vehicle and includes all gaps inside the column. Road space is normally expressed in kilometers.

(2) **Time factors.** Time is expressed as a quantity of hours or minutes. The following are terms used to describe time factors:

- *Time distance*--the amount of time required to move from one point to another at a given rate of march. It is the time required for the head of a column or any single vehicle of a column to move from one point to another at a given rate of march.
- *Time gap*--the amount of time measured between vehicles, march units, serials, or columns as they pass a given point. It is measured from the trail vehicle of one element to the lead vehicle of the following element.
- *Pass time*--the amount of time required for a convoy or its elements to pass a given point on a route.

c. **Arrive and Clear Time Calculations.** To complete a movement bid, the moving unit must calculate the arrive and clear time at SPs, en route CPs, and RPs. Arrive and clear times are not the same as time factors. Time factors measure a quantity of time or distance. Arrive and clear times are actual times as displayed on a clock.

The arrive time is the time the first vehicle in the column will arrive at an SP, CP, or RP. The arrive time is derived from the time distance. The clear time is the time the last vehicle in the column will clear that SP, CP, or RP. The clear time is derived from the pass time. The planner must determine the arrive and clear time for the entire column, consisting of the serials and march units within that column.

Calculate arrive times as follows: The arrive time at the SP is the same as the SP time. To calculate the arrive time at the first CP, take the distance from the SP to the first CP, divide by the planned rate of march, and multiply by 60 (minutes). Add this amount of time distance to the arrive time at the SP to determine the arrive time at the first CP.

EXAMPLE: Distance from SP to first CP: 10 km  
March rate: 50 KMIH

Solution:  $10 \div 50 = .20$  hours  $\times 60 = 12$  minutes

If the arrive time at the SP is 0800, then the arrive time at the first CP will be 0812.

To calculate the arrive time at the second CP, take the distance from the first CP to the second CP, divide by the planned rate of march, and multiply by 60 (minutes). Add this amount of time distance to the arrive time at the first CP to determine the arrive time at the second CP.

EXAMPLE: Distance from first to second CP: 15 km  
March rate: 50 KMIH

Solution:  $15 \div 50 = .30$  hours  $\times 60 = 18$  minutes

If the arrive time at the first CP is 0812, then the arrive time at the second CP will be 0830.

Continue this method to calculate the arrive time at succeeding CPs to the RP.

To calculate the clear times at each CP, planners must determine the pass time. Calculating pass time requires four calculations: density, time gaps, road space, and pass time.

$$\text{Density} = \frac{1,000 \text{ (meters)}}{\text{vehicle gap} + \text{avg length of vehicle}}$$

NOTE: Vehicle gap is expressed in meters, representing the gap between vehicles. Average length of vehicle is expressed in meters, representing the average length of the most common vehicle in the column.

EXAMPLE: If the vehicle gap is 100 meters and the average vehicle length is 18 meters, then--

$$\text{Density} = \frac{1,000}{100 + 18} = \frac{1,000}{118} = 8.5 \text{ vehicles per km}$$

$$\begin{aligned} \text{Time gaps} &= [(\text{number of march units} - 1) \\ &\quad \times \text{march unit time gap}] \\ &\quad + [(\text{number of serials} - 1) \\ &\quad \times (\text{serial time gap} - \text{march unit time gap})] \end{aligned}$$

EXAMPLE: If a column has two serials with two march units in each, the time gap between march units is 5 minutes and the time gap between serials is 10 minutes, then--

$$\begin{aligned} \text{Time gaps} &= [(4 - 1) \times 5] + [(2 - 1) \times 5] = \\ &= [3 \times 5] + [1 \times 5] = 15 + 5 = 20 \text{ minutes} \end{aligned}$$

$$\text{Road space} = \frac{\text{number of vehicles}}{\text{density}} + \frac{\text{time gaps} \times \text{rate}}{60 \text{ (minutes)}}$$

NOTE: Time gaps in the road space calculation are the total time gaps calculated for the column.

EXAMPLE:	number of vehicles	= 87
	density	= 8.5 per km
	rate	= 50 KMIH
	time gaps	= 20

$$\text{Road space} = \frac{87}{8.5} + \frac{20 \times 50}{60} = 10.2 + 16.7 = 26.9 \text{ km}$$

NOTE: In this example, the column will occupy 26.9 km of road space.

$$\text{Pass time} = \frac{\text{road space} \times 60}{\text{rate}}$$

EXAMPLE: Continuation from above

$$\text{Pass time} = \frac{26.9 \times 60}{50} = \frac{1,614}{50} = 32.2 \text{ or } 33 \text{ minutes}$$

NOTE: Always round up pass time regardless of the decimal value.

In this example, the clear time at the SP is 33 minutes after the first vehicle crosses the SP. If the arrive time at the SP is 0800, the clear time at the SP will be 0833. If the arrive time at the first CP is 0812, the clear time at the first CP will be 0845. Use this same method to calculate the arrive and clear times at succeeding CPs to the RP. This movement can be depicted as follows:

<u>CP</u>	<u>ARRIVE TIME</u>	<u>CLEAR TIME</u>
1	0800	0833
2	0812	0845
3	0830	0903

The pass time will stay the same throughout the route as long as the march rate and density do not change. If the march rate or density changes, then recalculate the pass time to determine the new clear time.

d. **Rest Halts.** While the march rate compensates for short halts, it does not include scheduled rest halts. Scheduled rest halts must be planned for during the movement planning process. Rest halts can either be scheduled at a CP or between CPs.

Planners should understand that scheduled rest halts require time to get vehicles off the road and staged, time to rest, and time to get vehicles back on the road. If 10 minutes is to be allowed for the rest halt, then 15 minutes should be scheduled. The extra time is needed to get vehicles on and off the road.

If a rest halt is scheduled at a CP, the arrive time at the CP does not change. The only thing that will change is the clear time at that CP and the arrive and clear time at succeeding CPs. The clear time must be adjusted by the scheduled halt time.

If a rest halt is scheduled between CPs, then the arrive and clear times at the next CP must be adjusted by the scheduled halt time.

Continuing with the previous example, if a 15-minute rest halt is planned between CP 2 and CP 3, the following adjustments to CP 3 are needed:

<u>CP</u>	<u>ARRIVE TIME</u>	<u>CLEAR TIME</u>
1	0800	0833
2	0812	0845
3	0845	0918

Note the 15-minute delay in arriving and clearing CP 3. If the rest halt was planned at CP 2, the following adjustment to the clear time at CP 2 and both the arrive and clear times at CP 3 are necessary:

<u>CP</u>	<u>ARRIVE TIME</u>	<u>CLEAR TIME</u>
1	0800	0833
2	0812	0900
3	0845	0918

Note the 15 minute delay in clearing CP 2, arriving at CP 3, and clearing CP 3.

e. **Movement Tables.** The procedures just described are used to calculate the arrive and clear times for an entire unit movement. That information is of no use to subordinate serial and march unit commanders. They will need to know the specific arrival and clear times for their serials and march units. Therefore, the movement planner must develop movement tables for these subordinate elements of the column.

Continuing with the example, you are assigned to the 150th Medium Truck Company, equipped with M915 tractors and M872 semitrailers. The company is augmented with an additional medium platoon. The unit will move from its present location to a new area and you must plan the move. You have read both the highway regulation plan and the traffic circulation plan and selected a route. The route requires that you submit a movement bid. The route you select is MSR DART. You will SP at CP 4 and RP at CP 13. You intend to SP at 0800. The following represents your route and the distances involved.

(SP) CP 4 to CP 8 = 10 km  
 CP 8 to CP 5 = 15 km  
 CP 5 to CP 1 = 10 km  
 CP 1 to CP 13 (RP) = 5 km

You calculate your time distance as follows:

Time Distance:

SP to CP 8 =  $10/50 \times 60 = 12$  minutes  
 CP 8 to CP 5 =  $15/50 \times 60 = 18$  minutes  
 CP 5 to CP 1 =  $10/50 \times 60 = 12$  minutes  
 CP 1 to RP =  $5/50 \times 60 = 6$  minutes

Your augmented company has 87 vehicles, which you divide into two serials with two march units in each serial. (You could have chosen to have all four march units in one serial.)

The first march unit has 22 vehicles with vehicles having an 18 meter average length. Calculate pass time for this march unit as follows:

Density =  $1000/100 + 18 = 1000/118 = 8.5$  vehicles per kilometer  
 Time Gaps = 0 (because you are calculating for only one march unit)  
 Road Space =  $\frac{22}{8.5} + \frac{0 \times 50}{60} = 2.6$  kilometers  
 Pass Time =  $\frac{2.6 \times 60}{50} = 3.1$  minutes = 4 minutes

REMINDER: Round up pass time regardless of the decimal value.

You then develop a movement table for the company movement. Table J-1 shows the completed movement table showing the arrive and clear times for each march unit in the company.

**Table J-1. Completed movement table**

150 Trans Co			
March Unit 1	Arrive	Clear	
	CP 4 0800	0804	
	CP 8 0812	0816	
	CP 5 0830	0834	
	CP 1 0842	0846	NOTE 5-MINUTE TIME GAP
	CP 13 0848	0852	BETWEEN MARCH UNITS
March Unit 2			
	CP 4 0809	0813	
	CP 8 0821	0825	
	CP 5 0839	0843	
	CP 1 0851	0855	NOTE 10-MINUTE TIME GAP
	CP 13 0857	0901	BETWEEN SERIALS
March Unit 3			
	CP 4 0823	0827	
	CP 8 0835	0839	
	CP 5 0853	0857	
	CP 1 0905	0909	NOTE 5-MINUTE TIME GAP
	CP 13 0911	0915	BETWEEN MARCH UNITS
March Unit 4			
	CP 4 0832	0836	
	CP 8 0844	0848	
	CP 5 0902	0906	
	CP 1 0914	0918	
	CP 13 0920	0924	

Note how the time distance is used to determine the arrive times. Also, that the pass time is added to each arrive time to obtain the clear time. If you compare the arrive and clear times of this movement table with the arrive and clear times calculated for the entire convoy, you will notice a slight deviation in the clear time at the RP. This is due to the rounding up of each march unit's pass time.

f. **Diverting and Rerouting.** Convoy commanders should realize that not all scheduled convoys will move according to scheduling. Traffic disruptions may be caused by enemy action that destroys bridges, damages MSRs, or contaminates MSRs. They may also be caused by refugees clogging an MSR, breakdowns, weather, or degradation of road surfaces. Highway regulation authorities may issue instructions to units to hold movements that have not begun or to issue new



routing instructions, hold movements at a staging area or CP if they have already begun, or reroute movements at a CP. Units must comply with these instructions as issued.

**J-3. COMPLETING A MOVEMENT BID.** Movement bids must contain all information pertaining to the unit movement. The following guidance will assist you in completing a movement bid such as the one shown in Figure J-1.

1. **TO:** The appropriate movement manager responsible for highway regulation in your area. This organization may be the DTO, movement control battalion, TMCA, or MC detachment.  
**THRU:** The higher headquarters or MC detachment servicing your area.  
**FROM:** The unit submitting the movement bid.
2. **MOVING UNIT:** Name of the moving unit.
3. **CONVOY CDR:** Convoy commander's name.
4. **START POINT/RELEASE POINT:** The SP should be located at a point along the MSR that will allow a march unit to be at the proper interval and rate. The RP should be at a point along the MSR that will allow the march unit to clear the RP without bunching up or slowing from planned rate of march. Include a six-digit grid coordinate and the nearest town or other quickly identifiable location.
5. **TYPE OF MOVEMENT:** Identify the kind of movement; for example, unit move or resupply convoy.
6. **MOVEMENT DATE/SP TIME:** Date and time the convoy will arrive at the SP.
7. **MOVEMENT CREDIT:** This space is reserved for the movement control unit that will issue the movement credit. When you receive permission to move, this will be returned and a movement credit number will be assigned. This number will be written on each vehicle in the convoy.
8. **CONVOY ORGANIZATION:** Identify the number of serials and march units that you will need to control your convoy. You also establish the time gaps between serials and march units as well as the vehicle gap.
9. **RATE OF MARCH:** Enter the rate of march you used to plan the movement.
10. **CHECKPOINTS:** List the CPs you will use along your route. Ensure the CPs are known to the movement agency. These may be established as part of the traffic circulation plan and should be used by all units moving through the area of operations.
11. **DISTANCE BETWEEN POINTS:** The measured distance stated in kilometers.
12. **ARRIVE AND CLEAR TIMES:** Identify the arrive time and clear time at each checkpoint. Use the times that you calculated using the planning formulas as explained earlier in this appendix.
13. **ROUTE DESCRIPTION:** Use the MSR names identified in the highway regulation plan or the traffic circulation plan. When MSRs are not previously identified, use the local highway or road designation.

14. **CRITICAL POINTS/HALTS:** Identify planned halts for refueling or driver rest. These locations may be at a checkpoint or between checkpoints. Also identify any critical points that you want to bring to the attention of the movement planner.
15. **NUMBER OF TRACKS:** Identify the total number of tracked vehicles that will travel in the convoy.
16. **NUMBER OF WHEELS:** Identify the total number of wheeled vehicles that will travel in the convoy.
17. **HEAVIEST VEH/WT/MLC:** Identify by model the heaviest vehicle class that will be in the convoy. Include the vehicle weight and MLC. Vehicle weight may be found in TB 55-46-1. The MLC should be affixed to the right front of the vehicle. FM 5-36, Appendix C, lists common vehicles and their MLC.
18. **VEHICLE CHARACTERISTICS AND INFORMATION:** List the total number of vehicles of each model type that will travel in the convoy. Vehicle data may be found in TB 55-46-1. Include peculiar load information that will assist movement managers in routing the convoy. All hazardous material must be identified.
19. **REQUESTER'S NAME:** Identify a point of contact with telephone number in case there are questions and changes to be coordinated. This point of contact should be familiar with the convoy organization and the data that was used in filling out the form.
20. **SECTION III:** This section is reserved for the agency that processes your movement bid. The agency uses this space for movement bid accountability and internal control.